

CLAIMS

What is claimed is:

- 5 1. An implantable cardiac stimulation device comprising:
 a sensing circuit that senses cardiac activity of a heart under
 control of a plurality of sensing parameters;
 a pulse generator that applies electrical energy to the heart;
 and
10 a processor that is connected to the sensing circuit and that
 is operative to adjust at least one of the sensing parameters based
 on an amplitude value and rate of sensed cardiac events of the
 sensed cardiac activity.
- 15 2. The device of claim 1 wherein the sensing circuit senses
 ventricular events of the heart.
3. The device of claim 1 wherein the sensing circuit senses atrial
 events of the heart.
- 20 4. The device of claim 1 wherein the sensing circuit has an initial
 sensing threshold, wherein the initial sensing threshold is one of the
 plurality of sensing parameters, and wherein the processor adjusts the
 initial sensing threshold in response to sensed cardiac event amplitude.
- 25 5. The device of claim 4 wherein the processor also decreases the
 initial sensing threshold in response to increased sensed cardiac event
 rate.
- 30 6. The device of claim 4 wherein the processor adjusts the initial
 sensing threshold in accordance with a percentage of the sensed cardiac
 event amplitude.

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7. The device of claim 6 wherein the processor decreases the percentage of the sensed cardiac event amplitude in response to increased sensed cardiac event rate.

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8. The device of claim 6 wherein the processor incrementally adjusts the percentage in accordance with sensed cardiac event rate limits.

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9. The device of claim 1 wherein the sensing circuit has a sensing threshold, wherein the sensing threshold decreases from an initial sensing threshold towards a minimum threshold between sensed cardiac events and at a decay rate, the decay rate being one of the sensing parameters, and wherein the processor adjusts the decay rate in response to sensed cardiac event rate.

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10. The device of claim 9 wherein the processor decreases the decay rate responsive to increased sensed cardiac event rate.

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11. The device of claim 9 wherein the processor incrementally adjusts the decay rate in accordance with sensed cardiac event rate limits.

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12. The device of claim 9 wherein the minimum threshold is one of the plurality of sensing parameters and wherein the processor increases the minimum threshold responsive to increased sensed cardiac event rate.

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13. The device of claim 9 wherein the minimum threshold is one of the plurality of sensing parameters and wherein the processor incrementally adjusts the minimum threshold in accordance with sensed cardiac event rate limits.

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14. The device of claim 1 further comprising a fibrillation detector that detects fibrillation of the heart in response to the sensed cardiac activity, and wherein the pulse generator applies defibrillating electrical
5 energy to the heart in response to detected fibrillation of the heart.

15. An implantable cardiac stimulation device comprising:
sensing means for sensing cardiac activity of a heart in
accordance with a plurality of sensing parameters; and
10 control means for adjusting at least one of the sensing
parameters based on an amplitude and rate of sensed cardiac
events of the sensed cardiac activity.

16. The device of claim 15 wherein the sensing means comprises
15 means for sensing ventricular events of the heart.

17. The device of claim 15 wherein the sensing means comprises
means for sensing atrial events of the heart.

18. The device of claim 15 wherein the sensing means has an
initial sensing threshold, wherein the initial sensing threshold is one of the
plurality of sensing parameters, and wherein the control means comprises
means for adjusting the initial sensing threshold in response to sensed
cardiac event amplitude.
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19. The device of claim 18 wherein the control means further
comprises means for decreasing the initial sensing threshold in response
to increased sensed cardiac event rate.

20. The device of claim 18 wherein the control means further
comprises means for adjusting the initial sensing threshold in accordance
with a percentage of the sensed cardiac event amplitude.
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21. The device of claim 20 wherein the means for adjusting comprises means for decreasing the percentage of the sensed cardiac event amplitude in response to increased sensed cardiac event rate.
22. The device of claim 20 wherein the means for adjusting comprises means for incrementally adjusting the percentage in accordance with sensed cardiac event rate limits.
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23. The device of claim 15 wherein the sensing means has a sensing threshold, the sensing threshold decreasing from an initial sensing threshold towards a minimum threshold between sensed cardiac events and at a decay rate, the decay rate being one of the sensing parameters, and wherein the control means comprises means for
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- adjusting the decay rate in response to sensed cardiac event rate.
24. The device of claim 23 wherein the means for adjusting comprises means for decreasing the decay rate responsive to increased sensed cardiac event rate.
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25. The device of claim 23 wherein the means for adjusting comprises means for incrementally adjusting the decay rate in accordance with sensed cardiac event rate limits.
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26. The device of claim 23 wherein the minimum threshold is one of the plurality of sensing parameters and wherein the control means comprises means for increasing the minimum threshold responsive to increased sensed cardiac event rate.
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27. The device of claim 23 wherein the minimum threshold is one of the plurality of sensing parameters and wherein the control means

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comprises means for incrementally adjusting the minimum threshold in accordance with sensed cardiac event rate limits.

28. The device of claim 15 further comprising detecting means for
5 detecting fibrillation of the heart in response to the sensed cardiac activity of the heart, and means for defibrillating the heart in response to detection of fibrillation of the heart.

29. In an implantable cardiac stimulation device, a method of
10 adjusting sensing parameters used in sensing cardiac events of a heart, the method comprising:
sensing cardiac events of the heart using a set of sensing parameters;
determining an amplitude value and rate of the sensed
15 cardiac events; and
adjusting the sensing parameters based upon the amplitude value and rate of the sensed cardiac events.

30. The method of claim 29 wherein sensing comprises sensing
20 ventricular events of the heart.

31. The method of claim 29 wherein sensing comprises sensing atrial events of the heart.

32. The method of claim 29 wherein one of the plurality of sensing
25 parameters is initial sensing threshold and wherein adjusting comprises varying the initial sensing threshold in response to sensed cardiac event amplitude.

33. The method of claim 32 wherein varying comprises decreasing
30 the initial sensing threshold in response to increased sensed cardiac event rate.

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34. The method of claim 32 wherein adjusting comprises varying the initial sensing threshold in accordance with a percentage of the sensed cardiac event amplitude.

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35. The method of claim 34 wherein varying comprises decreasing the percentage of the sensed cardiac event amplitude in response to increased sensed cardiac event rate.

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36. The method of claim 34 wherein adjusting comprises incrementally varying the percentage in accordance with sensed cardiac event rate limits.

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37. The method of claim 29 wherein the sensing parameters comprise at least one of sensing threshold, decay rate, and minimum threshold, wherein the sensing threshold decreases from an initial sensing threshold towards the minimum threshold between sensed cardiac events at the decay rate, and wherein adjusting comprises varying the decay rate in response to sensed cardiac event rate.

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38. The method of claim 37 wherein varying comprises decreasing the decay rate responsive to increased sensed cardiac event rate.

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39. The method of claim 37 wherein varying comprises incrementally adjusting the decay rate in accordance with sensed cardiac event rate limits.

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40. The method of claim 37 wherein adjusting comprises increasing the minimum threshold responsive to increased sensed cardiac event rate.

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41. The method of claim 37 wherein adjusting comprises incrementally varying the minimum threshold in accordance with sensed cardiac event rate limits.

5 42. A sensing system that senses cardiac events for use in an implantable cardiac stimulation device, the system comprising:
 a sensing circuit that senses cardiac events of a heart using
 a plurality of sensing parameters; and
 a processor that adjusts at least one of the sensing
10 parameters in response to an amplitude value and rate of the sensed cardiac events.

 43. The system of claim 42 wherein the sensing circuit senses
15 either atrial or ventricular events of the heart.

 44. The system of claim 42 wherein the sensing circuit has an
 initial sensing threshold, wherein the initial sensing threshold is one of the
 plurality of sensing parameters, and wherein the processor adjusts the
 initial sensing threshold in response to sensed cardiac event amplitude.
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 45. The system of claim 44 wherein the processor also decreases
 the initial sensing threshold in response to increased sensed cardiac
 event rate.

25 46. The device of claim 44 wherein the processor adjusts the initial
 sensing threshold in accordance with a percentage of the sensed cardiac
 event amplitude.

 47. The system of claim 46 wherein the processor decreases the
30 percentage of the sensed cardiac event amplitude in response to
 increased sensed cardiac event rate.

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48. The system of claim 46 wherein the processor incrementally adjusts the percentage in accordance with sensed cardiac event rate limits.

5 49. The system of claim 42 wherein the sensing circuit has a sensing threshold, wherein the sensing threshold decreases from an initial sensing threshold toward a minimum threshold between sensed cardiac events and at a decay rate, the decay rate being one of the sensing parameters, and wherein the processor adjusts the decay rate in
10 response to sensed cardiac event rate.

50. The system of claim 49 wherein the processor decreases the decay rate responsive to increased sensed cardiac event rate.

15 51. The system of claim 49 wherein the processor incrementally adjusts the decay rate in accordance with sensed cardiac event rate limits.

20 52. The system of claim 49 wherein the minimum threshold is one of the plurality of sensing parameters and wherein the processor increases the minimum threshold responsive to increased sensed cardiac event rate.

25 53. The system of claim 49 wherein the minimum threshold is one of the plurality of sensing parameters and wherein the processor incrementally adjusts the minimum threshold in accordance with sensed cardiac event rate limits.

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